

FORM PTO-1390 (REV. 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER VMP-490-A	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, see 37 CFR 1.5) <b>09/856787</b>	
INTERNATIONAL APPLICATION NO. PCT/EP99/06683		INTERNATIONAL FILING DATE 10 September 1999		PRIORITY DATE CLAIMED 26 November 1998	
TITLE OF INVENTION DRIVING DEVICE MAINLY INTENDED FOR THE WIPER SYSTEM OF A MOTOR VEHICLE					
APPLICANT(S) FOR DO/EO/US Bernd Walther					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.					
2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.					
3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.					
4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).					
5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))					
a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).					
b. <input type="checkbox"/> has been communicated by the International Bureau.					
c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).					
6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).					
a. <input checked="" type="checkbox"/> is attached hereto.					
b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).					
7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))					
a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).					
b. <input type="checkbox"/> have been communicated by the International Bureau.					
c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.					
d. <input type="checkbox"/> have not been made and will not be made.					
8. <input checked="" type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).					
9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).					
10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).					
Items 11 to 20 below concern document(s) or information included:					
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.					
12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.					
13. <input checked="" type="checkbox"/> A FIRST preliminary amendment.					
14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.					
15. <input checked="" type="checkbox"/> A substitute specification.					
16. <input type="checkbox"/> A change of power of attorney and/or address letter.					
17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.					
18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).					
19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).					
20. <input checked="" type="checkbox"/> Other items or information: Red-Line Specification					

U.S. APPLICATION NO. (If known)

097/856787

INTERNATIONAL APPLICATION NO.  
PCT/EP99/06683

VMP# 430A NUMBER

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

Neither international preliminary examination fee (37 CFR 1.482)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO  
and International Search Report not prepared by the EPO or JPO. .... \$1000.00International preliminary examination fee (37 CFR 1.482) not paid to  
USPTO but International Search Report prepared by the EPO or JPO ..... \$860.00International preliminary examination fee (37 CFR 1.482) not paid to USPTO  
but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$710.00International preliminary examination fee (37 CFR 1.482) paid to USPTO  
but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$690.00International preliminary examination fee (37 CFR 1.482) paid to USPTO  
and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

CALCULATIONS PTO USE ONLY

\$ 860

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(c)).

\$ 0

CLAIMS NUMBER FILED NUMBER EXTRA RATE \$

Total claims 15 -20 = 0 x \$18.00 \$

Independent claims 1 -3 = 0 x \$80.00 \$

MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00 \$

TOTAL OF ABOVE CALCULATIONS = \$ 860

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above  
are reduced by 1/2.

\$ 0

SUBTOTAL = \$ 860

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$ 0

TOTAL NATIONAL FEE = \$ 860

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$ 40

TOTAL FEES ENCLOSED = \$ 900

Amount to be  
refunded: \$

charged: \$

a. ☒ A check in the amount of \$ 900.00 to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees.  
A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
overpayment to Deposit Account No. 25-0115A duplicate copy of this sheet is enclosed.d. ☐ Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card  
information should not be included on this form. Provide credit card information and authorization on PTO-2038.NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR  
1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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William M. Hanlon, Jr.

NAME

28422

REGISTRATION NUMBER

09/856787

JC18 Rec'd PCW/FTO 2 5 MAY 2001

Our Reference: VMP-490-A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Bernd Walther
Serial Number:	Unknown
Filing Date:	Unknown
Examiner/Art Group Unit:	Unknown/Unknown
Title:	DRIVING DEVICE FOR THE WIPER SYSTEM OF A MOTOR VEHICLE

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents  
Washington, D.C. 20231

Sir:

Prior to initial examination, please amend the above-identified  
patent application as indicated below.

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In the claims:

1                    1.        (Amended) A driving device for the windshield wiper  
2        assembly of a motor vehicle, which has:  
3                    a housing,  
4                    an electric motor located in a housing with a pivoted armature,  
5                    a gear unit located in the housing with a worm shaft located on a  
6        section of the armature, and  
7                    an axial thrust generating device to compensate for the axial free  
8        play of the armature,  
9                    characterized in that one end of the armature is supported at the  
10       housing through a support bearing and that the axial thrust generating device  
11       possesses a tapered sliding member which is supported in the housing movable  
12       in the radial direction relative to the armature and is supported against the  
13       armature shaft so that axial force can be applied to the armature shaft in the  
14       direction of the support bearing by moving the tapered sliding member.

1                    2.        (Amended) The driving device in accordance with claim 1  
2        wherein the armature is supported in a roller bearing with an inner race located  
3        on the armature and an outer race located in one of the gear housing and in the  
4        motor housing.

1                    3.        (Amended) The driving device in accordance with claim 2,  
2        wherein the roller bearing is located between the worm shaft and the electric  
3        motor.

1                    4.        (Amended) The driving device in accordance with claim 2  
2        wherein the outer race is supported in the housing so that it is movable axially  
3        and wherein the tapered sliding member imparts an axial force to the outer race  
4        in the direction of the support bearing.

1                   5.       (Amended) The driving device in accordance with claim 4  
2 wherein the fixed inner race is attached to the armature, so that it can transfer an  
3 axial force acting on the outer race to the armature.

1                   6.       (Amended) The driving device in accordance with claim 5  
2 wherein a fixed thrust washer is located on the armature on the side of the roller  
3 bearing facing away from the tapered sliding member.

1                   7.       (Amended) The driving device in accordance with claim 6  
2 wherein the thrust washer is formed as a clamp ring which is located on the  
3 armature in an annular groove formed in the armature.

1                   8.       (Amended) The driving device in accordance with claim 1,  
2 wherein the tapered sliding member is formed basically U-shaped, where the  
3 armature runs in the gap between the two parallel legs of the U.

1                   9.       (Amended) The driving device in accordance with claim 2,  
2 wherein the housing possesses a collar-shaped area which extends radially  
3 inward, through which the armature runs and on which the tapered sliding  
4 member is supported.

1                   10.      (Amended) The driving device in accordance with claim 9  
2 wherein the surface of the collar-shaped area on which the tapered sliding  
3 member is supported has a bevel which matches the bevel on the surface of the  
4 tapered sliding member on which the latter is supported in the collar-shaped  
5 area.

1                   11.      (Amended) The driving device in accordance with claim 1,  
2 wherein a displacing force can be applied to the tapered sliding member by  
3 means of a spring element.

1 12. (Amended) The driving device in accordance with claim 11  
2 wherein the spring element is constructed as a helical spring.

1 13. (Amended) The driving device in accordance with claim 11  
2 wherein the spring element is constructed as a leaf spring.

1 14. (Amended) The driving device in accordance with claim 11  
2 wherein the spring element is constructed as a rubber spring.

1 15. (Amended) The driving device in accordance with claim 11  
2 wherein the spring element is constructed as a plastic spring.

REMARKS

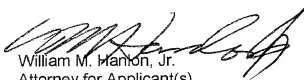
After entry of this amendment, claims 1 - 15 are amended to place the claims in idiomatic English and preferred United States claim format. The claim amendments are not made to address issues of patentability or art.

A hand-written, corrected copy of the specification is enclosed showing the changes which have been made to the specification as required by Section 608.01(Q) and 714.20(1) of the Manual of Patent Examining Procedure. The Substitute Specification filed herewith has been amended to utilize idiomatic English, correct minor typographical and grammatical errors and to conform the application to current United States patent practice. The Substitute Specification includes no new subject matter; but does include the same changes handwritten in red in the attached, corrected, original specification. Entry of the Substitute Specification is respectfully requested.

It is submitted that this Amendment has antecedent basis in the application as originally filed, including the specification, claims and drawings, and that this Amendment does not add any new subject matter to the application. Consideration of the application as amended is requested.

Respectfully submitted,

YOUNG, BASILE, HANLON, MacFARLANE, WOOD  
& HELMHOLDT, P.C.



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Dated: May 25, 2001  
WMH/jao

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**VERSION OF CLAIM AMENDMENTS WITH MARKINGS**  
**TO SHOW CHANGES MADE**

1                   1.       (Amended) [Driving device (1), mainly] A driving device for  
2       the windshield wiper assembly of a motor vehicle, which has:  
3                   [-] a housing [(3)],  
4                   [-] an electric motor [(2)] located in a housing [(3)] with a pivoted  
5       armature [(4)],  
6                   [-] a gear unit located in the housing [(3)] with a worm shaft [(6)]  
7       located on a section of the armature [(4)], and  
8                   [-] an axial thrust generating device [(8)] to compensate for the axial  
9       free play of the armature [(4)],  
10                  characterized in that one end [(5)] of the armature [(4)] is supported  
11       at the housing [(3)] through a support bearing [(7)] and that the axial thrust  
12       generating device [(8)] possesses a tapered sliding member [9] which is  
13       supported in the housing [(3)] movable in the radial direction relative to the  
14       armature [(4)] and is supported against the armature shaft so that axial force can  
15       be applied to the armature shaft [(4)] in the direction of the support bearing [(7)]  
16       by moving the tapered sliding member [(9)].

1                   2.       (Amended) [Driving] The driving device [(1)] in accordance  
2       with claim 1 wherein the armature [(4)] is supported in a roller bearing [(13)] with  
3       an inner race [(13')] located on the armature [(4)] and an outer race [(13'')]  
4       located in one of the gear housing [3 or] and in the motor housing.

1                   3.       (Amended) [Driving] The driving device [(1)] in accordance  
2       with claim 2, wherein the roller bearing [(13)] is located between the worm shaft  
3       [(6)] and the electric motor [(2)].

1                   4.       (Amended) [Driving] The driving device [(1)] in accordance  
2       with claim 2 [or 3.] wherein the outer race [(13'')] is supported in the housing [(3)]

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so that it is movable axially and wherein the tapered sliding member [(9)] imparts an axial force to the outer race [(13'')] in the direction of the support bearing [(7)].

5. (Amended) [Driving] The driving device [(1)] in accordance with claim 4 wherein the fixed inner race [(13')] is attached to the armature [(4)], so that it can transfer an axial force acting on the outer race [(13'')] to the armature [(4)].

6. (Amended) [Driving] The driving device [(1)] in accordance with claim 5 wherein a fixed thrust washer is located on the armature [(4)] on the side of the roller bearing facing away from the tapered sliding member [(9)].

7. (Amended) [Driving] The driving device [(1)] in accordance with claim 6 wherein the thrust washer [(14)] is formed as a clamp ring which is located on the armature [(14)] in an annular groove [(15)] formed in the armature [(14)].

8. (Amended) [Driving] The driving device [(1)] in accordance with [one of the claims 1 to 7] claim 1, wherein the tapered sliding member [(9)] is formed basically U-shaped, where the armature [(4)] runs in the gap between the two parallel legs of the U.

9. (Amended) [Driving] The driving device [(1)] in accordance with [one of the claims] claim 2 [to 8], wherein the housing [(3)] possesses a collar-shaped area [(11)] which extends radially inward, through which the armature [(4)] runs and on which the tapered sliding member [(9)] is supported.

10. (Amended) [Driving] The driving device [(1)] in accordance with claim 9 wherein the surface of the collar-shaped area [(11)] on which the tapered sliding member [(9)] is supported has a bevel which matches the bevel on the surface of the tapered sliding member [(9)] on which the latter is supported in the collar-shaped area [(11)].



## SUBSTITUTE SPECIFICATION

Our Reference: VMP-490-A

PATENT

**[0001]      DRIVING DEVICE FOR THE WIPER SYSTEM OF A MOTOR VEHICLE****BACKGROUND**

[0002]                    The present invention relates to a driving device, mainly intended for the wiper system of a motor vehicle, which possesses a housing, an electric motor located in the housing with a pivoted armature shaft, a gear unit located in the housing with a worm shaft located on one section of the armature shaft, and an axial force generating device to compensate for the end play in the armature shaft.

[0003]                    The housing of the driving device is subdivided into a section in which the electric motor is located, and a section in which the gear unit is located. The section of the housing in which the electric motor is located will be described henceforth as the motor housing, the section of the housing in which the gear unit is located will be described as the gear housing.

[0004]                    A driving device of this type is known, for example, from German patent application 196 52 929. The driving device revealed there is used mainly to drive a windshield wiper system in a motor vehicle. It possesses an electric motor which is flange-mounted to a gear housing. The electric motor possesses an armature shaft which extends into the gear housing at its free end. The free end of the armature shaft has a worm shaft to drive a worm gear of a gear unit housed in the gear housing.

[0005]                    The sloping flanks of the worm shaft and the worm gear cause an axial force during operation of the driving device, which impinges on the armature shaft. The direction of the axial force depends on the direction of rotation of the armature shaft. At the points where the windshield wiper changes direction, the direction of the axial force on the drive shaft reverses briefly, because the gear unit is being loaded in the opposite direction. Because of manufacturing tolerances for the individual components of the driving device and because of operating wear in the area of the thrust

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## SUMMARY

[0010] In the driving device according to the invention, the armature shaft can be supported against the support bearing through the gear housing or the motor housing. Depending on which method is chosen, the support bearing is located either in the motor housing or in the gear housing. The tapered sliding member is always located and formed in such a way that it applies an axial force to the armature shaft in the direction of the support bearing.

[0012] In accordance with an advantageous development of the invention, the armature shaft is supported in a roller bearing with an inner race located on the armature shaft and an outer race located in the housing. Only the driving device in accordance with the invention allows the end play of the armature shaft to be fully compensated for if only one roller bearing is

used. The driving device can consequently be made with fewer moving parts. That results in higher availability and in lower manufacturing costs for the driving device according to the invention. The roller bearing is advantageously located between the worm gear and the electric motor.

[0013] In accordance with another preferred development of the present invention, it is proposed that the outer race is supported in the housing axially movable and that the tapered sliding member applies an axial force to the outer race in the direction of the support bearing.

[0014] The fixed inner race is advantageously located on the armature shaft, so that it can transfer axial force affecting the outer race to the armature shaft. The inner race is, for example, attached by means of a press fit on the armature shaft. The axial force from the axial force generating device affecting the outer race of the roller bearing in the direction of the support bearing can thus be transferred over the roller bearing to the armature shaft. The armature shaft is thereby positioned in the housing in the axial direction between the axial force generating device and the support bearing without any resulting deleterious effect on the rotational properties of the armature shaft.

[0015] In accordance with a preferred embodiment, a fixed thrust washer is located on the armature shaft on the side of the roller bearing facing away from the tapered sliding member. The thrust washer is located on the side of the roller bearing facing the support bearing. The inner race of the roller bearing can be supported against the thrust washer. As a result, the axial force affecting the roller bearing can be fully transferred by the inner race to the armature shaft.

[0016] The thrust washer is preferably formed as a clamp ring, which is located on the armature shaft in an annular groove on the armature shaft. A thrust washer formed in this way can be installed easily and is secured against axial displacement on the armature shaft.

[0017] In accordance with a particularly preferred development of the invention, the tapered sliding member is basically U-shaped, where the

armature runs in the gap between the two parallel legs of the U. In this way it is ensured that in the area of the two legs the tapered sliding member acts on the outer race symmetrically and applies equal axial force to it in the direction of the support bearing.

[0018]

In accordance with an advantageous embodiment, it is proposed that the housing has a collar-shaped area which extends radially inwards, through which the armature passes and on which the tapered sliding member is supported. The tapered sliding member can be supported against the housing over a large surface in this area.

[0019]

The surface of the collar-shaped area against which the tapered slider is supported, possesses advantageously a bevel which matches the bevel on the surface of the tapered sliding member by which the latter is supported in the collar-shaped area. The surface of the tapered sliding member, which is supported on the outer bearing race, runs perpendicular to the armature and thus lies against the outer bearing race over a large area. By displacing the tapered sliding member in a radial direction relative to the armature, the tapered sliding member slides along the bevel of the collar-shaped area. As a result, the tapered sliding member is forced to move in an axial direction, in addition to its sliding radial movement. As a result of this movement of the tapered sliding member in an axial direction, an axial force is imparted to the outer race in the direction of the support bearing.

[0020]

It is conceivable for a displacement force to be imparted to the tapered sliding member by means of a threaded element or other manual means of adjustment. In this way, a desired displacement force, and thus a desired axial force as well, could be permanently set during production of the driving device, for example. However, the end play of the armature can increase with time as the result of operating wear of the axial bearing elements of the input shaft or of the support bearing. In that case the displacement force acting on the tapered sliding member would have to be reset using manual methods of adjustment. For this reason, an automatic

self-adjusting axial force generating device is particularly advantageous. So the invention proposes in accordance with a particularly preferred embodiment that a displacement force is applied to the tapered sliding member by means of a spring element.

[0021]

The spring element is preferably formed as a coil spring. Alternatively, it is proposed that the spring element is formed as a leaf spring. By designing a very stiff leaf spring, the tapered sliding member can be subjected to particularly high displacement forces. The spring element consists preferably of rubber or plastic.

[0022]

In accordance with a particularly preferred embodiment of the present invention, it is proposed that the armature is mounted pivotably in the gear housing and that similarly the support bearing is located in the gear housing. In this way the armature can be securely held between two points in the part of the housing for the driving device in which the gear unit is located.

#### [0023] BRIEF DESCRIPTION OF THE DRAWING

[0024]

A preferred embodiment of the present invention is explained in greater detail below using the drawings in which:

[0025]

Fig. 1 depicts a driving device according to the invention in a side view and partially in section; and

[0026]

Fig. 2 shows the driving device from Fig. 1 in a plan view, partially in section.

#### DETAILED DESCRIPTION

[0027]

In Figure 1 a driving device in accordance with the invention is identified in its entirety with reference numeral 1. The driving device 1 is used, for example, as the drive of a windshield wiper system in a motor vehicle. It possesses a housing 3 in which an electric motor 2 is located. The electric motor 2 is housed in a part of the housing 3 described as the motor housing. The electric motor 2 is flange-mounted to a part of the housing 3 described as the gear housing. The electric motor 2 possesses an armature 4, which extends into the gear housing with its free end 5. The armature 4

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has a worm drive 6 on its free end to drive a worm gear (not shown) on a gear unit (not shown) housed in the gear housing 3.

[0028]

During operation of the driving device 1, the sloping flanks of the worm drive 6 and of the worm gear result in an axial force acting on the armature. The direction of the axial force is dependent on the direction of rotation of the armature 4. At the points where the windshield wiper switches direction, the direction of the axial force on the drive shaft 4 reverses briefly, because the gear unit is under load in the opposite direction. Because of manufacturing tolerances in the individual components of the driving device 1 resulting from operating wear of the thrust bearing elements of the drive shaft 4, the result can be relatively large end play of the axial shaft 4 in its thrust bearings. As a result of the end play, a reversal of direction can cause abrupt axial movement of the armature, which causes irritating noises.

[0029]

In order to compensate for the end play of the armature 4, it is proposed in the case of the driving device 1 according to the invention that the free end 5 of the armature 4 is supported against the housing 3 by means of a support bearing 7. The driving device 1 additionally possesses an axial force generating device 8, which applies an axial force to the armature 4 generated in the direction of the support bearing 7. The axial force generating device 8 has a tapered sliding member 9, which is supported movably in the radial direction relative to the armature 4 and is supported at the armature 4, so that axial force in the direction of the support bearing 7 can be applied to the armature 4 as a result of moving the tapered sliding member 9. To do this, a displacement force in the direction of the tip 10 of the tapered sliding member 9 is applied to the tapered sliding member 9. The housing 3 possesses a collar-shaped area 11 extending radially inward, through which the armature 4 passes and on which the tapered sliding member 9 is supported. The surface of the collar-shaped area 11 possesses a bevel which matches the bevel on the surface of the tapered sliding member 9, and against which the latter is supported on the collar-shaped area 11.

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[0030] The tapered sliding member 9 in the plan view (see Fig. 2) is essentially U-shaped in construction. The armature 4 runs in the gap between the two parallel legs of the U. The displacement force is applied to the tapered sliding member 9 by means of a spring element 12.

[0031] The armature 4 rides in a roller bearing 13. The roller bearing 13 possesses an inner race 13' located on the armature 4 and an outer race 13'' located in the housing 3. The roller bearing is located between the worm drive 6 and the electric motor 2. The outer race 13'' is axially movably mounted in the housing 3. The tapered sliding member 9 imparts an axial force in the direction of the support bearing 7 to the outer race 13''. The fixed inner race is mounted on the armature 4 so that it can transfer an axial force imparted in the direction of the support bearing 7 to the armature 4. In this way, the axial thrust of the tapered sliding member 9 is transferred over the roller bearing 13 to the armature 4. A fixed thrust washer 14 is mounted on the armature 4 on the side of the roller bearing 13 facing away from the tapered sliding member 9. The thrust washer 14 is constructed as a clamp ring which is located on the armature 4 in an annular groove 15 in the armature 4.

What is Claimed Is:

1. Driving device (1), mainly for the windshield wiper assembly of a motor vehicle, which has
  - a housing (3),
  - an electric motor (2) located in a housing (3) with a pivoted armature (4),
  - a gear unit located in the housing (3) with a worm shaft (6) located on a section of the armature (4), and
  - an axial thrust generating device (8) to compensate for the axial free play of the armature (4),characterized in that one end (5) of the armature (4) is supported at the housing (3) through a support bearing (7) and that the axial thrust generating device (8) possesses a tapered sliding member (9) which is supported in the housing (3) movable in the radial direction relative to the armature (4) and is supported against the armature shaft so that axial force can be applied to the armature shaft (4) in the direction of the support bearing (7) by moving the tapered sliding member (9).
2. Driving device (1) in accordance with claim 1 wherein the armature (4) is supported in a roller bearing (13) with an inner race (13') located on the armature (4) and an outer race (13') located in one of the gear housing (3) or in the motor housing.
3. Driving device (1) in accordance with claim 2, wherein the roller bearing (13) is located between the worm shaft (6) and the electric motor (2).
4. Driving device (1) in accordance with claim 2 or 3, wherein the outer race (13') is supported in the housing (3) so that it is

movable axially and wherein the tapered sliding member (9) imparts an axial force to the outer race (13') in the direction of the support bearing (7).

5. Driving device (1) in accordance with claim 4 wherein the fixed inner race (13') is attached to the armature (4), so that it can transfer an axial force acting on the outer race (13') to the armature (4).

6. Driving device (1) in accordance with claim 5 wherein a fixed thrust washer is located on the armature (4) on the side of the roller bearing facing away from the tapered sliding member (9).

7. Driving device (1) in accordance with claim 6 wherein the thrust washer (14) is formed as a clamp ring which is located on the armature (14) in an annular groove (15) formed in the armature (14).

8. Driving device (1) in accordance with one of the claims 1 to 7, wherein the tapered sliding member (9) is formed basically U-shaped, where the armature (4) runs in the gap between the two parallel legs of the U.

9. Driving device (1) in accordance with one of the claims 2 to 8, wherein the housing (3) possesses a collar-shaped area (11) which extends radially inward, through which the armature (4) runs and on which the tapered sliding member (9) is supported.

10. Driving device (1) in accordance with claim 9 wherein the surface of the collar-shaped area (11) on which the tapered sliding member (9) is supported has a bevel which matches the bevel on the surface of the tapered sliding member (9) on which the latter is supported in the collar-shaped area (11).



[0032]

The invention is a driving device mainly for the windshield wiper assembly of a motor vehicle, which has a housing, an electric motor located in a housing with a pivoted armature, a gear unit located in the housing with a worm shaft located on a section of the armature and an axial force generating device to compensate for the axial free play of the armature. In order to create a driving device of the simplest possible construction in which the axial force generating device does not have to absorb all of the axial forces from the armature and which nevertheless can properly compensate for the axial free play of the armature, one end of the armature is supported by a support bearing at the housing and that the axial force generating device has a tapered sliding member which rides movably in the housing in a radial direction relative to the armature and is supported at the armature so that an axial force running in the direction of the support bearing can be applied to the armature by moving the tapered slide.

Applicant:

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3826447

09/09/1999

Title: Driving Device, Mainly Intended for the Wiper System of a  
Motor Vehicle

Description

- 10 The present invention relates to a driving device, mainly  
intended for the wiper system of a motor vehicle, which possesses
- a housing
  - an electric motor located in the housing with a pivoted armature  
shaft,
  - a gear unit located in the housing with a worm shaft located on one  
15 section of the armature shaft and
  - an axial force generating device to compensate for the end play in the  
armature shaft.

- 20 The housing of the driving device is subdivided into a section  
in which the electric motor is located, and a section in which the gear unit is  
located. The section of the housing in which the electric motor is located will  
be described henceforth as the motor housing, the section of the housing in  
which the gear unit is located will be described as the gear housing.

- 25 A driving device of this type is known, for example, from  
German patent application 196 52 929. The driving device revealed there is  
used mainly to drive a windshield wiper system in a motor vehicle. It  
possesses an electric motor which is flange-mounted to a gear housing. The  
electric motor possesses an armature shaft which extends into the gear  
housing at its free end. The free end of the armature shaft has a worm shaft  
to drive a worm gear of a gear unit housed in the gear housing.

The sloping flanks of the worm shaft and the worm gear cause an axial force during operation of the driving device, which impinges on the armature shaft. The direction of the axial force depends on the direction of rotation of the armature shaft. At the points where the windshield wiper changes direction, the direction of the axial force on the drive shaft reverses briefly, because the gear unit is being loaded in the opposite direction. Because of manufacturing tolerances for the individual components of the driving device and because of operating wear in the area of the thrust bearings of the drive shaft, the result can be a relatively large end play of the drive shaft in its thrust bearings. The consequence of the end play can be abrupt axial movement of the armature shaft when the windshield wiper reverses direction, which causes irritating noises.

In order to reduce this end play, the armature shaft in the known driving device runs in two roller bearings, on both sides of the worm drive. The roller bearings have an inner race located on the armature shaft and a fixed outer race attached to the gear housing. The inner race of one of the two roller bearings is located such that it can move on the armature shaft. An axial force generating device bears against the inner race and it exerts an axial force on the armature shaft relative to the inner race. In the area of the other roller bearing, a fixed thrust washer is mounted to the armature shaft. The inner race of the other roller bearing is supported against the armature shaft through the thrust washer in such a way that it transmits the axial thrust acting on the armature shaft to the inner race of the other roller bearing. In this way the armature shaft is positioned between the roller bearings in the axial direction. The positioning forces are passed into the gear housing through the roller bearings. This positions the armature shaft in the axial direction relative to the gear housing.

The axial force generating device possesses a spring element which bears against the armature shaft at one end and at the other end against the inner race of one of the roller bearings. The spring element of the axial force generating device has to absorb all of the axial forces from



the armature shaft being generated in the direction of the gear unit while the driving device is operating. Moreover, this known driving device requires the use of at least two roller bearings, between which the armature shaft can be kept positioned.

5           The task of the present invention is to continue the development and design of the driving device of the type named at the beginning such that it is constructed in the simplest way, that the axial force generating device does not have to absorb all the axial forces from the armature shaft and that it can still fully compensate for the end play of the  
10 armature shaft.

          In order to fulfil this task the invention proposes, starting with the driving device of the type named at the beginning, that one end of the armature shaft is supported via a support bearing against the housing and that the axial force generating device has a tapered sliding member which  
15 can move in the housing in a radial direction relative to the armature shaft and is supported on the armature shaft so that an axial force can be applied to the armature shaft in the direction of the support bearing by moving the tapered sliding member.

          In the driving device according to the invention, the armature  
20 shaft can be supported against the support bearing through the gear housing or the motor housing. Depending on which method is chosen, the support bearing is located either in the motor housing or in the gear housing. The tapered sliding member is always located and formed in such a way that it applies an axial force to the armature shaft in the direction of the support  
25 bearing.

          The driving device according to the invention is simple in construction. The axial force generating device for the driving device does not have to absorb all the entire axial forces from the armature shaft. The slope of the tapered sliding member can be selected such that the axial  
30 forces affecting the armature shaft are converted by the tapered sliding member into substantially smaller displacement forces in a radial direction.

In addition, the driving device according to the invention can fully compensate for the end play of the armature shaft.

In accordance with an advantageous development of the invention, the armature shaft is supported in a roller bearing with an inner race located on the armature shaft and an outer race located in the housing. Only the driving device in accordance with the invention allows the end play of the armature shaft to be fully compensated for if only one roller bearing is used. The driving device can consequently be made with fewer moving parts. That results in higher availability and in lower manufacturing costs for the driving device according to the invention. The roller bearing is advantageously located between the worm gear and the electric motor.

In accordance with another preferred development of the present invention it is proposed that the outer race is supported in the housing axially movable and that the tapered sliding member applies an axial force to the outer race in the direction of the support bearing.

The fixed inner race is advantageously located on the armature shaft, so that it can transfer axial force affecting the outer race to the armature shaft. The inner race is, for example, attached by means of a press fit on the armature shaft. The axial force from the axial force generating device affecting the outer race of the roller bearing in the direction of the support bearing can thus be transferred over the roller bearing to the armature shaft. The armature shaft is thereby positioned in the housing in the axial direction between the axial force generating device and the support bearing without any resulting deleterious effect on the rotational properties of the armature shaft.

In accordance with a preferred embodiment, a fixed thrust washer is located on the armature shaft on the side of the roller bearing facing away from the tapered sliding member. The thrust washer is located on the side of the roller bearing facing the support bearing. The inner race of the roller bearing can be supported against the thrust washer. As a result,

the axial force affecting the roller bearing can be fully transferred by the inner race to the armature shaft.

The thrust washer is preferably formed as a clamp ring, which is located on the armature shaft in an annular groove on the armature shaft.

- 5 A thrust washer formed in this way can be installed easily and is secured against axial displacement on the armature shaft.

- 10 In accordance with a particularly preferred development of the invention, the tapered sliding member is basically U-shaped, where the armature runs in the gap between the two parallel legs of the U. In this way it is ensured that in the area of the two legs the tapered sliding member acts on the outer race symmetrically and applies equal axial force to it in the direction of the support bearing.

- 15 In accordance with an advantageous embodiment, it is proposed that the housing has a collar-shaped area which extends radially inwards, through which the armature passes and on which the tapered sliding member is supported. The tapered sliding member can be supported against the housing over a large surface in this area.

- 20 The surface of the collar-shaped area against which the tapered slider is supported, possesses advantageously a bevel which matches the bevel on the surface of the tapered sliding member by which the latter is supported in the collar-shaped area. The surface of the tapered sliding member, which is supported on the outer bearing race, runs perpendicular to the armature and thus lies against the outer bearing race over a large area. By displacing the tapered sliding member in a radial
- 25 direction relative to the armature, the tapered sliding member slides along the bevel of the collar-shaped area. As a result, the tapered sliding member is forced to move in an axial direction, in addition to its sliding radial movement. As a result of this movement of the tapered sliding member in an axial direction, an axial force is imparted to the outer race in the direction of
- 30 the support bearing.

It is conceivable for a displacement force to be imparted to the tapered sliding member by means of a threaded element or other manual means of adjustment. In this way, a desired displacement force, and thus a desired axial force as well, could be permanently set during production of the driving device, for example. However the end play of the armature can increase with time as the result of operating wear of the axial bearing elements of the input shaft or of the support bearing. In that case the displacement force acting on the tapered sliding member would have to be reset using manual methods of adjustment. For this reason, an automatic self-adjusting axial force generating device is particularly advantageous. So the invention proposes in accordance with a particularly preferred embodiment that a displacement force is applied to the tapered sliding member by means of a spring element.

The spring element is preferably formed as a coil spring. Alternatively it is proposed that the spring element is formed as a leaf spring. By designing a very stiff leaf spring, the tapered sliding member can be subjected to particularly high displacement forces. The spring element consists preferably of rubber or plastic.

In accordance with a particularly preferred embodiment of the present invention, it is proposed that the armature is mounted pivotably in the gear housing and that similarly the support bearing is located in the gear housing. In this way the armature can be securely held between two points in the part of the housing for the driving device in which the gear unit is located.

A preferred embodiment of the present invention is explained in greater detail below using the drawings.

Fig. 1a driving device according to the invention in a side view and partially in section; and

Figure 2 shows the driving device from Fig. 1 in a plan view partially in section.

In Figure 1 a driving device in accordance with the invention is identified in its entirety with the reference numeral 1. The driving device 1 is used, for example, as the drive of a windshield wiper system in a motor vehicle. It possesses a housing 3, in which an electric motor 2 is located.

- 5 The electric motor 2 is housed in a part of the housing 3 described as the motor housing. The electric motor 2 is flange-mounted to a part of the housing 3 described as the gear housing. The electric motor 2 possesses an armature 4, which extends into the gear housing with its free end 5. The armature 4 has a worm drive 6 on its free end to drive a worm gear (not shown) on a gear unit (not shown) housed in the gear housing 3.

- 10 During operation of the driving device 1, the sloping flanks of the worm drive 6 and of the worm gear result in an axial force acting on the armature. The direction of the axial force is dependent on the direction of rotation of the armature 4. At the points where the windshield wiper switches direction, the direction of the axial force on the drive shaft 4 reverses briefly, because the gear unit is under load in the opposite direction. Because of manufacturing tolerances in the individual components of the driving device 1 resulting from operating wear of the thrust bearing elements of the drive shaft 4, the result can be relatively large end play of the axial shaft 4 in its thrust bearings. As a result of the end play, a reversal of direction can cause abrupt axial movement of the armature, which causes irritating noises.

- 20 In order to compensate for the end play of the armature 4, it is proposed in the case of the driving device 1 according to the invention that the free end 5 of the armature 4 is supported against the housing 3 by means of a support bearing 7. The driving device 1 additionally possesses an axial force generating device 8, which applies an axial force to the armature 4 generated in the direction of the support bearing 7. The axial force generating device 8 has a tapered sliding member 9, which is supported movably in the radial direction relative to the armature 4 and is supported at the armature 4, so that axial force in the direction of the support bearing 7 can be applied to the armature 4 as a result of moving the tapered
- 25
- 30

sliding member 9. To do this, a displacement force in the direction of the tip 10 of the tapered sliding member 9 is applied to the tapered sliding member 9. The housing 3 possesses a collar-shaped area 11 extending radially inward, through which the armature 4 passes and on which the tapered sliding member 9 is supported. The surface of the collar-shaped area 11 possesses a bevel which matches the bevel on the surface of the tapered sliding member 9, and against which it [the latter] is supported on the collar-shaped area 11.

The tapered sliding member 9 in the plan view (c.f. Fig. 2) is essentially U-shaped in construction. The armature 4 runs in the gap between the two parallel legs of the U. The displacement force is applied to the tapered sliding member 9 by means of a spring element 12.

The armature 4 rides in a roller bearing 13. The roller bearing 13 possesses an inner race 13' located on the armature 4 and an outer race 13" located in the housing 3. The roller bearing is located between the worm drive 6 and the electric motor 2. The outer race 13" is mounted in the housing 3 axially movable. The tapered sliding member 9 imparts an axial force in the direction of the support bearing 7 to the outer race 13". The fixed inner race is mounted on the armature 4 so that it can transfer an axial force imparted in the direction of the support bearing 7 to the armature 4. In this way the axial thrust of the tapered sliding member 9 is transferred over the roller bearing 13 to the armature 4. A fixed thrust washer 14 is mounted on the armature 4 on the side of the roller bearing 13 facing away from the tapered sliding member 9. The thrust washer 14 is constructed as a clamp ring which is located on the armature 4 in an annular groove 15 in the armature 4.

What is Claimed Is:

1. Driving device (1), mainly for the windshield wiper assembly of a motor vehicle, which has

- a housing (3),
- 5 - an electric motor (2) located in a housing (3) with a pivoted armature (4),
- a gear unit located in the housing (3) with a worm shaft (6) located on a section of the armature (4) and
- an axial thrust generating device (8) to compensate for the
- 10 axial free play of the armature (4),

characterized in that one end (5) of the armature (4) is supported at the housing (3) through a support bearing (7) and that the axial thrust generating device (8) possesses a tapered sliding member (9) which is supported in the housing (3) movable in the radial direction relative to the armature (4) and is supported against the armature shaft so that axial force can be applied to the armature shaft (4) in the direction of the support bearing (7) by moving the tapered sliding member (9).

2. Driving device (1) in accordance with claim 1 wherein the armature (4) is supported in a roller bearing (13) with an inner race (13') located on the armature (4) and an outer race (13'') located in the gear housing (3) or in the motor housing.

3. Driving device (1) in accordance with claim 2, wherein the roller bearing (13) is located between the worm shaft (6) and the electric motor (2).

4. Driving device (1) in accordance with claim 2 or 3, wherein the outer race (13'') is supported in the housing (3) so that it is movable axially and wherein the tapered sliding member (9) imparts an axial force to the outer race (13'') in the direction of the support bearing (7).

5. Driving device (1) in accordance with claim 4 wherein the fixed inner race (13') is attached to the armature (4), so that it can transfer an axial force acting on the outer race (13 ") to the armature (4).

6. Driving device (1) in accordance with claim 5 wherein a fixed thrust washer is located on the armature (4) on the side of the roller bearing facing away from the tapered sliding member (9).

7. Driving device (1) in accordance with claim 6 wherein the thrust washer (14) is formed as a clamp ring which is located on the armature (14) in an annular groove (15) formed in the armature (14).

8. Driving device (1) in accordance with one of the claims 1 to 7, wherein the tapered sliding member (9) is formed basically U-shaped, where the armature (4) runs in the gap between the two parallel legs of the U.

9. Driving device (1) in accordance with one of the claims 2 to 8, wherein the housing (3) possesses a collar-shaped area (11) which extends radially inward, through which the armature (4) runs and on which the tapered sliding member (9) is supported.

10. Driving device (1) in accordance with claim 9 wherein the surface of the collar-shaped area (11) on which the tapered sliding member (9) is supported has a bevel which matches the bevel on the surface of the tapered sliding member (9) on which the latter is supported in the collar-shaped area (11).

11. Driving device (1) in accordance with one of the claims 1 to 10, wherein a displacing force can be applied to the tapered sliding member (9) by means of a spring element (12).





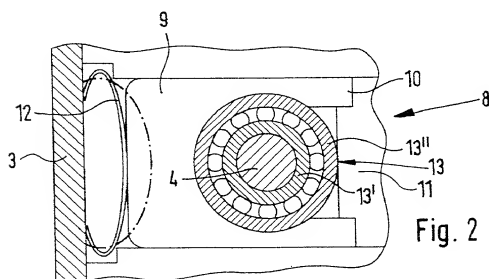
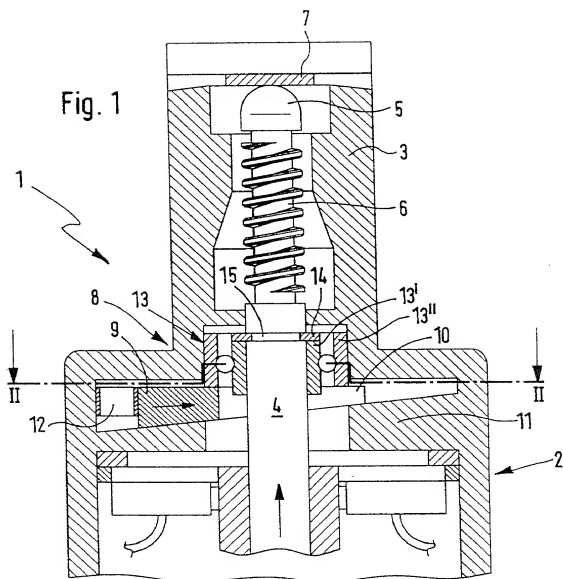
## Abstract

The invention relates to a driving device (1), mainly for the windshield wiper assembly of a motor vehicle, which has

- a housing (3),
- 5       - an electric motor (2) located in a housing (3) with a pivoted armature (4),
- a gear unit located in the housing (3) with a worm shaft (6) located on a section of the armature (4) and
- an axial force generating device (8) to compensate for the
- 10   axial free play of the armature (4). In order to create a driving device (1) of the simplest possible construction in which the axial force generating device (8) does not have to absorb all of the axial forces from the armature (4) and which nevertheless can properly compensate for the axial free play of the armature (4), the invention proposes that one end (5) of the armature (4) is
- 15   supported by means of a support bearing (7) at the housing (3) and that the axial force generating device (8) has a tapered sliding member (9) which rides movably in the housing (3) in a radial direction relative to the armature (4) and is supported at the armature (4) so that an axial force running in the direction of the support bearing (7) can be applied to the armature (4) by
- 20   moving the tapered slide (9).

(Figure 1)

1 / 1



## POWER OF ATTORNEY:

I hereby appoint the following attorney(s) and/or agent(s) J. Gordon Lewis, Patent Office Registration No. 28735, Andrew R. Basile, Patent Office Registration No. 24753, William M. Hanlon, Jr., Patent Office Registration No. 28422, and Thomas D. Helmholdt, Patent Office Registration No. 33181, as my attorney(s) and/or agent(s), to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Our Reference: VMP-490-A (MP9588)

**COMBINED DECLARATION AND POWER OF ATTORNEY****DECLARATION:**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**DRIVING DEVICE MAINLY INTENDED FOR THE WIPER SYSTEM OF A MOTOR VEHICLE**

the specification of which (check only one item below):

☐ I is attached hereto.☐ I was filed as United States application Serial No. \_\_\_\_\_ on \_\_\_\_\_, and was amended on or through \_\_\_\_\_ (if applicable).☒ [X] was filed as PCT international application Number PCT/EP99/06683 on 10 September 1999, and was amended under PCT Article 19 on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate or §365(a) of any PCT international application(s) which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT international application(s) having a filing date before that of the application on which priority is claimed:

Prior Foreign/PCT Application(s) and any Priority Claims Under 35 U.S.C. § 119:

Priority Claimed

<u>198 54 535.5</u>	<u>Germany</u>	<u>26 November 1998</u>	<input checked="" type="checkbox"/> [X]	<input type="checkbox"/> [ ]
(Number)	(Country)	(Day/Mo/Yr Filed)	Yes	No
_____	_____	_____	<input type="checkbox"/> [ ]	<input type="checkbox"/> [ ]
(Number)	(Country)	(Day/Mo/Yr Filed)	Yes	No

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

_____	_____
(Application Number)	(Filing Date)
_____	_____
(Application Number)	(Filing Date)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or §365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Prior U. S. Application(s) or PCT International Application(s) Designating the U.S. for Benefit Under 35 U.S.C. §120:

_____	_____	_____
(Application Number)	(Filing Date)	(Status: patented, pending, abandoned)
_____	_____	_____
(Application Number)	(Filing Date)	(Status: patented, pending, abandoned)

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